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PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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988,962

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COMPLETE SPECIFICATION.

Improvements in and relating to Hydraulic Automatic Clutches.

We, IKARUS KAROSSZERIA ES JARMUGYAR, of Margit utca 2, Budapest-Matyasfold, Hungary, a Body Corporate organised under the Laws of Hungary, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a hydraulic automatic clutch, more particularly for motor vehicles.

Clutches are used in motor vehicles for disconnecting the engine from the driven members of the vehicle, generally during the starting, stopping and during gear changes. The frequent starts, stops, gear changes and the consequent frequent operation of the clutch in town traffic result in considerable fatigue of the driver, both physical and mental.

Friction clutches have the advantage of simple construction, reliability and very high efficiency, however, a drawback is the sudden, shock-like stress, especially in town traffic, since the friction clutch is incapable of reducing the shocks incurred during the gear change which produce considerable stresses on the transmission means.

Although hydraulic clutches and transmissions eliminate the shock stresses and do not require any special effort by the driver, they are rather expensive and of low efficiency. In these arrangements, there is no pedal and the driver need only operate the accelerator and brake pedals, allowing him to devote more attention to traffic conditions. Change gears with layshafts are not used in hydraulic transmissions because these cannot ensure a detachable connection. For this reason, hydraulic transmissions use generally epicyclic change gears operated by friction clutches. The change is here automatic and gear change is necessary only in exceptional cases, for example during reversing or braking by means of the engine. Although tests to combine hydraulic clutches with layshaft units resulted in automatic starting, in order to ensure the gear change, the incorporation of a separate friction clutch was necessary. There are already known constructions for rendering the friction clutch automatic, such as flyweights, electric or electro-pneumatic actuation; however, these are not very reliable and tend to be subject to accelerated wear and overheating. There are also constructions in which the gear change was secured by forced synchronisation, but these have not become accepted owing to their unreliability and expensiveness.

The present invention consists in a hydraulic automatic clutch, especially for motor vehicles, comprising a hydrokinetic circuit speed responsive means on a driving member, a control ring slidably received in the hydrokinetic circuit and adapted to regulate the fluid flow therein, the control ring being adapted to rotate relative to the driving member under control from the speed responsive means, the said relative rotational movement being converted to an axial sliding motion to regulate the fluid flow by follower slots cooperating with pins in the driving member.

The automatic hydraulic clutch according to the invention renders the link between engine and drive automatic and maintains the reliable layshaft gearing. This eliminates the clutch pedal and makes possible a comfortable two-pedal control, comprising the accelerator and brake pedals. The gear change is effected during the movement without disconnecting the drive, by operating the layshaft gearing. The automatic

[*Price* 4*s*. 6*d*.]

Price 25p

clutch may be combined with a freewheeling device. If the engine is to be used for braking, the freewheel may be blocked. According to the invention, the vehicle may also be started by pushing.

The operation of the hydraulic clutch according to the invention is effected preferably by means of a centrifugal governor which controls the cross-section of the fluid flow in the hydraulic circuit. Flow is possible with the engine at a standstill, so that the engine can be started by pushing. When the engine reaches its idling speed, the flow cross-section of the hydraulic circuit closes. With a further increase in the speed, the flow section opens rapidly and effects a reliable connection between engine and gearing. The clutch is preferably connected with a blockable freewheeling device, enabling gear change both after reducing the engine speed and with disconnected friction clutch. The freewheeling device differs from known arrangements in that the rollers are capable of transmitting the torque in either direction. The freewheeling device may also be blocked.

Our automatic hydraulic clutch makes full use of the proved steps of the layshaft type of transmission. This type of transmission facilitates the control of the vehicle in that the necessity of a gear change occurs only infrequently, owing to the elasticity of the hydraulic connection. With heavy traffic, where neither high speeds not considerable tractive efforts are required, the vehicle may travel in any chosen gear. In this case gear change is completely unnecessary and the driver may fully concentrate on the traffic conditions. The automatic hydraulic clutch ensures a quiet, soft, starting and protects not only the driver and co-driver, but also the entire transmission system.

Our automatic hydraulic clutch may also be fitted into vehicles where hitherto only friction clutches could be used, that is, in motor cars or lorries with low gearing performances, owing to the high efficiency, simple construction and easy operation of our automatic device.

Further details of the invention will become apparent from the following description with reference to the accompanying drawings, in which:—

Figure 1 is an axial cross-section of the automatic hydraulic clutch;

Figure 2 is a vertical cross-section of the automatic hydraulic clutch;

Figure 3 is a part of the regulating follower groove of the automatic hydraulic clutch;

Figure 4 is an axial cross-section of the freewheeling device of the clutch;

Figure 5 is a cross-section of this freewheeling device.

According to the drawing, the cover 5 is screwed on to the flywheel 1 of the engine by means of a sealing ring 2. The pump vanes 4 are located on the inside of the cover 5. Opposite the pump vanes 4, the turbine vanes 6 are mounted on the transmission shaft. The pump vanes and the turbine vanes 6 are interconnected hydraulically. Between the cover 5 and the shaft 7, there is a sealing ring 3. On the inner end of the flywheel 1, an edge plate 8 is centrally mounted. At the edge of the edge plate 8 arcuate springs are provided so that they face one another. These springs 9 carry fly-weights 10. The free ends of the springs 9 form tubes and are connected with the follower pins 12 of a disc 11. By the movement of the fly-weights 10, the pins 12 are rotated by the springs 9 about the centre of the disc 11. The springs 9, flyweights 10, disc 11 and follower pins 12 form together a centrifugal regulator. Perpendicularly relative to the path of the hydraulic flow caused by the pump vanes 4, and above the turbine vanes 6, there is mounted a control ring 13, mounted slidably on the pins 12 and rotatable therewith. The inner edge of the flywheel 1 carries follower pins 15 in order to move the control ring 13 into the path of the hydraulic flow. These follower pins 15 extend into follower slots 14 provided on the surface of the control ring 13. These follower slots 14 are so arranged as to move the control ring 13 in one direct driving transition from zero to the idling speed of the driving member, namely flywheel 2, and in the opposite direction during further increase of speed, whereby fluid flow is inhibited at idling speed and allowed at normal operating speeds and when the driving member is stationary.

The cover 5 has also the filler orifice 16 and a pressure-relieving valve 17.

The end of the shaft 7 or its extension carries a hub 18. At the centre of the hub 18, there is a bearing 19, in which shaft 20 leading to the change gear, freely revolves. A disc 21 is fitted on the shaft 20. A ring 22 is fitted by screws to the edge of the disc 21 and extends over the hub 18. The circumference of the hub 18 is planed at three points, offset by about 120°, in the direction normal to the radius so that rollers 23 may freely revolve between the flat parts of the hub 18 and the ring 22, in the centre of these flat surfaces, but can be wedged between ring 22 and the outer regions of the flat surfaces. These rollers 23 are guided in a cage 24, equipped with locking holes. Into these holes extend locking bolts or pins 26 fitted into grooves of the hub 18, placed 120° apart. The dimensions of these pins 26 and the roller cage 24 are such that the pins 26 permit the displacement of the ring 24, in one direction, only so far that the rollers 23 may freely revolve, so that the rollers can

be wedged only in the opposite direction: i.e. pins 26 serve to prevent wedging of rollers 23 in one direction. Opposite the centre of the flat portion of the hub 18 there are bores connecting the circumference of the hub 18 with the shaft holding the hub. Each bore contains a locking pin 26 which is urged by a support spring 25 against the centre of the hub 18. On the side facing the hub, the ends of the pins 26 are wedge-shaped or rounded (see Fig 4). These wedge-shaped end portions of the pins 26 cooperate with wedge-shaped lifting rods 27 which are slidable in grooves of the hub 18 adjacent the shaft and may be moved by the gear change fork 28.

The automatic hydraulic clutch shown in the drawing and described above operates as follows:—

The device is filled through the filler hole 16 in the cover 5 of the flywheel 1 with the liquid suitable for the hydraulic transmission. With the engine stationary, the springs 9 are in their basic position and rest on the pins 12. They also hold the control ring 13 prepared for starting. In this starting position, the flow section is partly open. With the engine started, the transmission fluid is moved by the rotation of the suction vanes 4 following the rotation of the flywheel. The fluid flow reaches through the open cross-section the turbine vanes 6. The centrifugal force generated by the rotation of the flywheel 1 displaces by means of the springs 9 the flyweights 10 from the centre. In consequence, the springs 9 rotate the pins 12 about the centre of the disc 11. With this rotation of the pins 12 there follows also the rotation of the control ring 13 causing relative sliding of the pins 15 and the follower grooves 14 so that the control ring moves longitudinally along pins 12 over the turbine vanes 6, thus narrowing the fluid flow path. Complete closure of the fluid flow path is effected when the engine is idling. In this case, the transmitted torque is so small that it cannot overcome the rolling resistance of the vehicle. Thus, the vehicle remains at standstill at idling speed even with the gear engaged. With increasing speed, and in consequence of the centrifugal force, the flyweights 10 continue to move towards the periphery of the flywheel 1 and carry along the springs 9. The springs 9 rotate the pins 12 about the centre of the disc 11. Owing to the rotation of the pins 12, the control ring 13 continues to rotate. In this way, the pins 15 located in the grooves 14 push the ring 13 back in the axial direction of the pins 12, causing the fluid path to be opened again so that the fluid may reach the vanes 6 and these may commence to revolve. With the further increase in the speed, the flow section is fully opened; the control ring 13 assumes its operating position connected with the engine speed and the pins 12 are again fully pushed back. Apart from a slight transmission loss, the engine torque is again fully effective. The control ring 13, guided by the follower slots 14 and pins 15, ensures therefore the fluid flow both during operation and during standstill of the engine, but closes it during idling. The shape of the follower slots 14 ensures that flow occurs when the engine speed departs in either direction from the idling speed of the engine.

The engine when at standstill may also be started by pushing or pulling the vehicle since the fluid path is open also during the inoperative condition of the engine.

In order to ensure reliable gear changing and to improve economy, a freewheeling device is connected with the hydraulic clutch. The freewheeling device is located between the clutch and the gear change gearing. This freewheeling device may be blocked and is adapted to transmit a torque in both directions.

The engine torque is transmitted by a wedging effect by means of the rollers 23 acting in the cage between the flat surfaces of the hub 18 and the ring 22. In the blocked condition of the freewheeling device, the mounting pins 26 are in their basic position, that is, they are urged by the springs 25 against the centre of the hub 18. After the engine has been started up, the rollers 23 are wedged between the ring 22 and the flat faces of the hub 18, in the side opposite to the direction of rotation. In the case of engine-assisted braking or a reduction of the engine speed, the driven wheels act as driving members and the rollers 23 are wedged in the opposite direction between the ring 22 and the flat surfaces of the hub 18. When the free wheeling device is actuated, the mounting pins are guided on movement of the gear change fork 28 by means of the lifting rod 27 into the holes of the cage 24 holding the rollers 23. The rollers can then exert their wedging action only in one direction. When the engine is driven, the rollers 23 are wedged between the ring 22 and the flat surfaces of the hub 18. When the engine speed drops, this wedging effect ceases to be effective, and the pins 26 by engaging the holes of the cage 24 prevent the rollers 23 from becoming wedged in the opposite direction. The freewheeling device is then effective. The hydraulic clutch interrupts the link between the engine and the driven parts only when the engine is idling. In this way, the freewheeling device ensures easy gear changing during motion. The gear change is effected by throttling the engine, when the gear can be easily changed or engaged. In order to engage a gear with the engine at a standstill, for example, reverse, the ring 22 may be braked, by means not shown, for example by means of a band

brake, in order to prevent frictional rotation. With the braking of the ring 22, the rolling friction is replaced which is ineffective in the gearing during idling conditions.

The automatic hydraulic clutch is protected by a pressure-relief valve 17 against overheating and consequent excess pressures.

WHAT WE CLAIM IS:—

1. A hydraulic automatic clutch, especially for motor vehicles, comprising a hydrokinetic circuit speed responsive means on a driving member, a control ring slidably received in the hydrokinetic circuit and adapted to regulate the fluid flow therein, the control ring being adapted to rotate relative to the driving member under control from the speed responsive means, the said relative rotational movement being converted to an axial sliding motion to regulate the fluid flow by follower slots cooperating with pins in the driving member.

2. A hydraulic automatic clutch as claimed in claim 1, in which the follower slots are arranged to move the control ring in one direct driving transition from zero to idling speed of the driving member and in the opposite direction during further increases of speed, whereby fluid flow may be inhibited at idling speed and allowed at normal operating speeds and when the driving member is stationary.

3. A hydraulic automatic clutch as claimed in claim 1 or 2, comprising a lockable freewheeling device, connected in series with the clutch, and including rollers or balls which may exert a wedging effect in both senses of rotation and means for preventing such wedging in one sense of rotation.

4. A hydraulic automatic clutch, substantially as described herein, with reference to, and as illustrated in Figs. 1 to 3 of the accompanying drawings.

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Agents for the Applicants.

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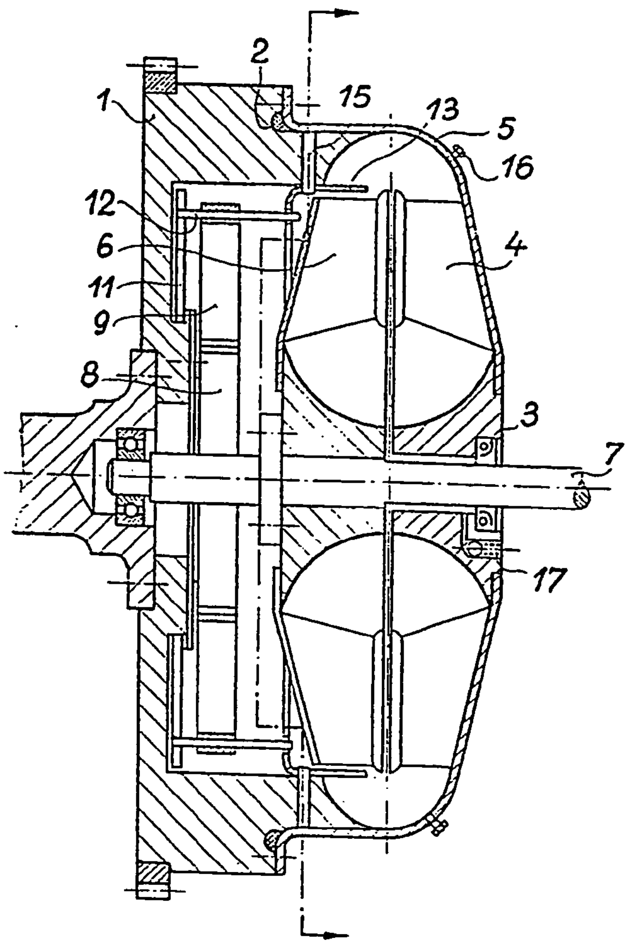

Fig. 1

988962 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

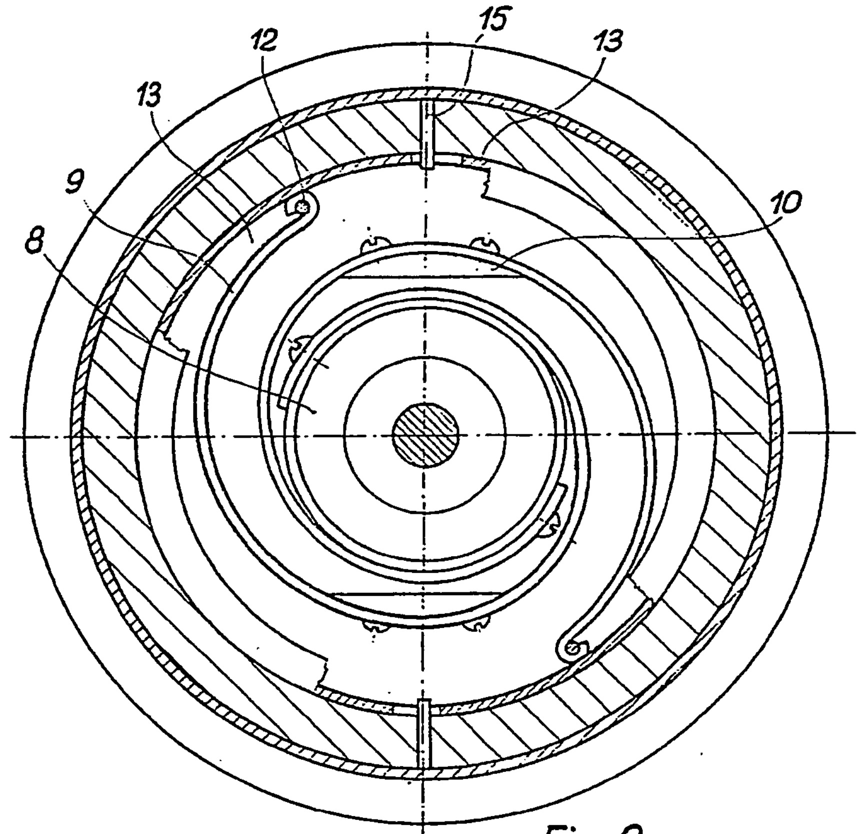

Fig.2

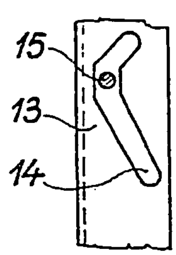

Fig.3

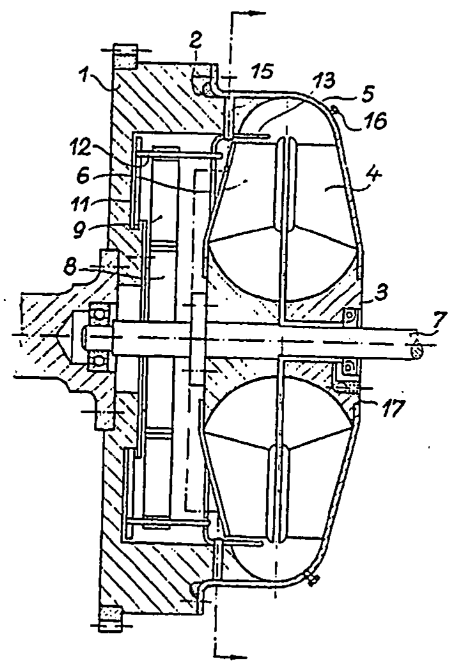

Fig. 1

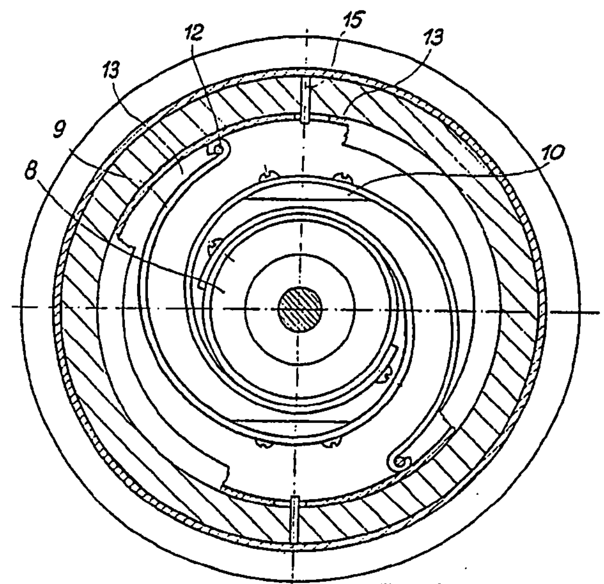

Fig.2

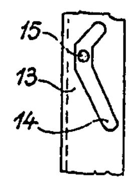

Fig.3

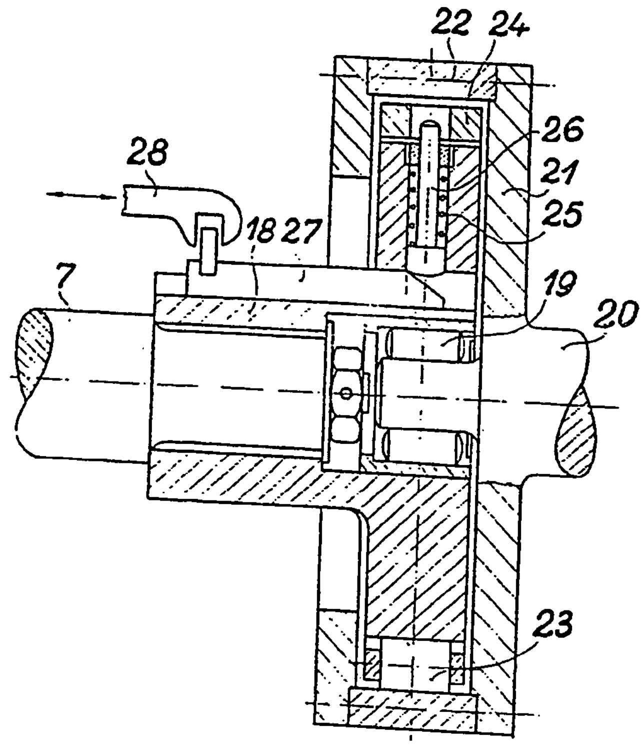

Fig. 4

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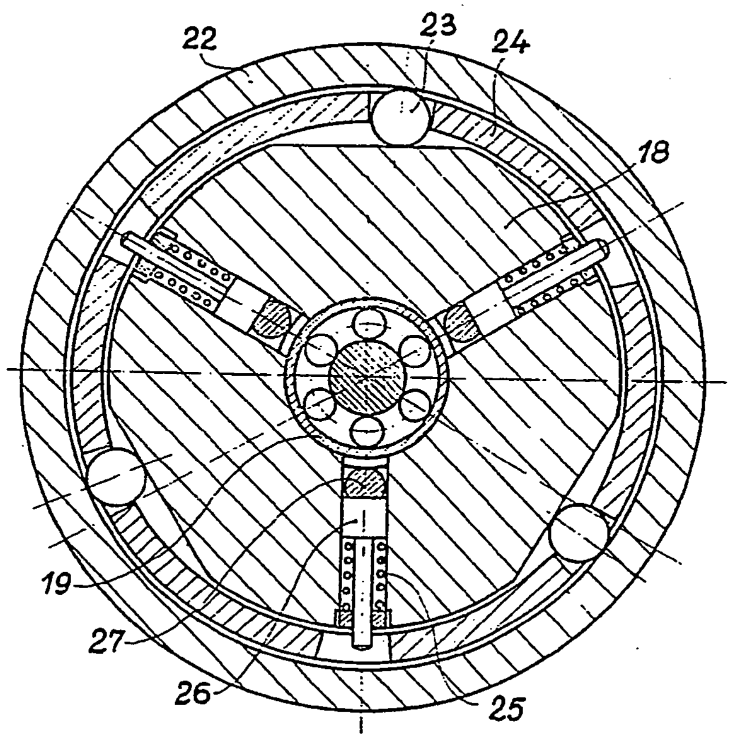

Fig. 5

988962 COMPLETE SPECIFICATION
4 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheets 3 & 4

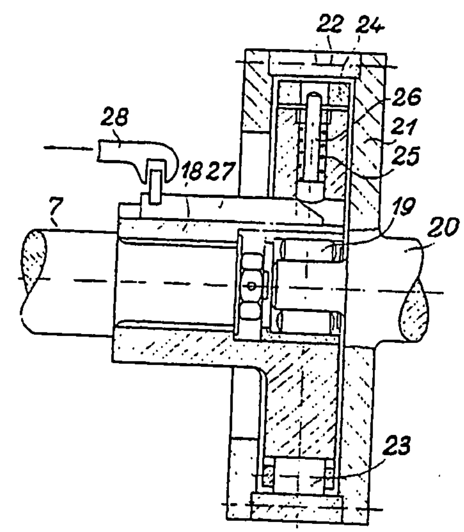

Fig. 4

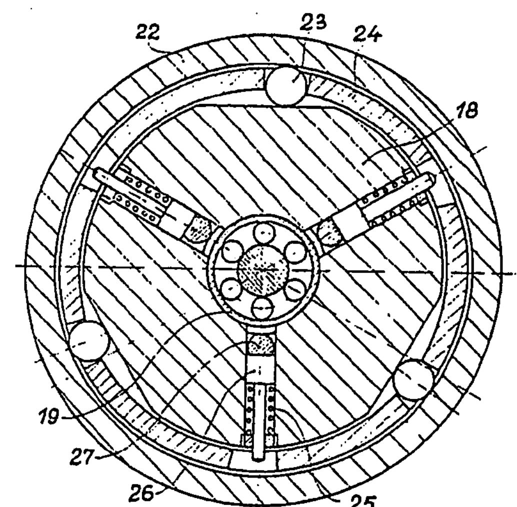

Fig. 5